CLAIMS

We claim:

1. A radio-frequency identification interrogator for use with a passive radio frequency identification (RFID) tag, the interrogator comprising:

a frequency-hopping source configured to sequentially generate radio-frequency signals at pseudo-randomly selected frequencies;

a transmitter coupled to the frequency-hopping source and to an antenna circuit and configured to transmit the generated radio-frequency signals on the antenna circuit;

a heterodyne receiver coupled to the antenna circuit and configured to receive on the antenna circuit reflected radio-frequency signals from the RFID tag; and

a signal processor coupled to the antenna circuit and to the heterodyne receiver, wherein the signal processor is configured to receive the reflected radio-frequency signals and to extract data contained within the reflected radio-frequency signals that correspond to the frequency of the transmitted radio-frequency signals.

2. The interrogator of claim 1, wherein the heterodyne receiver comprises a super-heterodyne receiver.

3. The interrogator of claim 1, wherein the antenna circuit comprises a first antenna and a second antenna, and the transmitter is configured to transmit the radio-frequency signals on the first antenna and the receiver is configured to receive the reflected radio-frequency signals on the second antenna.

4. The interrogator of claim 3, further comprising a low-noise amplifier coupled to the second antenna and to the heterodyne receiver, wherein the low-noise amplifier is configured to amplify the received reflected radio-frequency signals.

5. The interrogator of claim 1, wherein the frequency-hopping source is configured to sequentially generate radio-frequency signals at regular time intervals.

6. The interrogator of claim 1, wherein the transmitter is configured to modulate the pseudo-randomly selected radio-frequency signals.

7. A remote communication method for use with a radio-frequency identification (RFID) system having an RFID interrogator and a non-active RFID tag device, the method comprising:

sequentially generating radio-frequency signals at pseudo-randomly selected frequencies using a frequency-hopping source in the RFID interrogator;

transmitting the radio-frequency signals from the RFID interrogator;

reflecting the transmitted radio-frequency signals at the RFID tag device;

receiving reflected radio-frequency signals from the RFID tag device using a heterodyne reception technique; and

extracting data contained within the reflected radio-frequency signals that correspond to the frequency of the transmitted radio-frequency signals.

8. The method of claim 7, wherein the heterodyne reception technique is a super-heterodyne reception technique.

9. The method of claim 7, wherein the RFID interrogator transmits the generated radio-frequency signals from a first antenna and receives the reflected radio-frequency signals on a second antenna.

10. The method of claim 9, further comprising amplifying the received reflected radio-frequency signals using a low-noise amplifier.

11. The method of claim 7, wherein the sequentially generated radio frequency signals are generated at regular time intervals.

12. The method of claim 7, further comprising:

modulating the pseudo-randomly selected radio-frequency signals;

extracting data from the modulated, transmitted radio-frequency signals at the RFID tag device; and

storing data in the RFID tag device based on the data extracted at the RFID tag device.

13. The method of claim 7, further comprising:

modulating the pseudo-randomly selected transmitted radio-frequency signals;

extracting data from the modulated, transmitted radio-frequency signals at the RFID tag device; and

modulating the reflected radio-frequency signal based on the data extracted at the RFID tag device.

14. A device for communicating with a remote, non-active radio-frequency identification (RFID) tag, comprising:

means for sequentially generating radio-frequency signals at pseudo-randomly selected frequencies using a frequency-hopping source of an RFID interrogator;

means for transmitting the radio-frequency signals from the RFID interrogator;

a heterodyne receiver configured to receive the radio-frequency signals that are reflected from the RFID tag; and

means for extracting data contained within the reflected radio-frequency signals, the extracting means configured to receive the transmitted radio frequencies and to process data from the reflected radio-frequency signals that correspond to the frequency of the transmitted radio-frequency signals.

15. The device of claim 14, wherein the means for transmitting the radio-frequency signals comprise a first antenna and the heterodyne receiver comprises a second antenna.

16. The device of claim 15, further comprising a low-noise amplifier for amplifying the received reflected radio-frequency signals.

17. The device of claim 14, further comprising means for modulating the pseudo-randomly selected radio-frequency signals prior to transmission.

18. A radio-frequency identification (RFID) system, comprising:

an RFID device configured to reflect radio-frequency signals via continuous-wave backscatter; and

an RFID interrogator configured to generate and transmit pseudo-randomly selected radio-frequency signals over time and to receive, using a heterodyne reception technique, modulated radio-frequency signals reflected from the RFID.

19. The system of claim 18, wherein the interrogator comprises a frequency-hopping source configured to generate the pseudo-randomly selected radio-frequency signals.

20. The system of claim 18, wherein the RFID device comprises a passive RFID tag device.

21. The system of claim 18, wherein the interrogator comprises:

a frequency-hopping source configured to sequentially generate radio-frequency signals at pseudo-randomly selected frequencies;

a transmitter coupled to a first antenna and configured to transmit the generated radio-frequency signals on the first antenna;

a heterodyne receiver coupled to a second antenna and configured to receive on the second antenna the reflected radio-frequency signals from RFID device; and

a signal processor coupled to the first antenna to receive the transmitted radio-frequency signals and coupled to the heterodyne receiver to receive the reflected radio-frequency signals, wherein the signal processor is configured to extract data from the reflected radio-frequency signals that correspond to the transmitted radio-frequency signals.

22. The system of claim 18, wherein the interrogator is further configured to modulate the pseudo-randomly selected transmitted radio-frequency signals and the RFID device is further configured to extract data from the transmitted signals.

23. The system of claim 22, wherein the RFID device is further configured to store data based on the data extracted from the transmitted radio-frequency signals.

24. The system of claim 18, wherein the RFID device is further configured to modulate the reflected radio-frequency signal and the modulation is based on the extracted data.